



## New Lamb Products Unveiled in USDA Research Project

A PROGRAM of research and development sponsored by the U. S. Department of Agriculture and undertaken by the Pennsylvania State University Meats Laboratory has resulted in several new products based on the less expensive, less desired portions of the lamb carcass. These products are mainly precooked, frozen convenience items suitable for either retail or institutional trade.

The rapid increase in sales of frozen foods of all types from \$162 million in 1942 to \$7,033 million in 1968 illustrates that this is the fastest growing sector of the U. S. food industry. One-eighth of the 1968 sales of frozen food items was derived from meat products. Thus in this area of such rapid and continuing growth the opportunities for successful new meat products are likely to be excellent.

Compared with other meats, lamb for frozen products may have some advantages in lower fluid loss on thawing, less structural damage due to freezing, and good keeping qualities. And the equipment required for production of these products is similar to that commonly used by most food processors, so in most cases existing equipment can be readily utilized.

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A short description of each new lamb product follows. Details concerning the preparation of the various lamb dishes, estimates for production costs, acceptability studies, and other aspects are obtainable from the Eastern Marketing and Nutrition Research Division. In all cases, the estimated costs are based on laboratory experience only. In the event of volume purchasing and handling, automation, and other economizing steps made possible in a commercial operation, costs would be likely to drop considerably. Estimates of fixed and variable costs for plant and equipment vary from one plant to another. Distribution costs would likewise depend on whether these products fitted into existing distribution channels and product lines of a firm or represented an unfamiliar type of product.

In view of these considerations,

it is not advisable or accurate to extrapolate the costs presented here to a normal commercial production situation. Nevertheless, it is believed that the estimates will serve as a guide for those contemplating processing and/or distribution of these new lamb products.

### Lamb Curry

This is a fully prepared and cooked meat dish in the form of a sauce made from cubes of lamb shoulder, seasoning, and fruits and vegetables. It is designed to be packed in frozen form and stored in boilable bags. On reheating it may be served over rice, various types of noodles, or on toast for quick convenient meals.

Dehydrated vegetables and non-fat dried milk may be used instead of fresh milk without loss in flavor. Acceptability dropped slightly in tests when dehydrated apples were

Table 1. INGREDIENTS AND PROJECTED COSTS FOR LAMB CURRY  
The Pennsylvania State University 1970

Ingredient	Quantity		Unit cost (cents/lb.)	Total cost (dollars)
	Pounds	Per cent		
Water	125.00	36.45	—	—
Lamb <sup>1</sup>	100.00	29.17	100.00	100.00
Tomato sauce	50.00	14.59	28.00	14.00
Apples	44.00	12.83	8.33	3.67
Onion (dehydrated)	10.00	2.92	64.00	6.40
Corn starch	3.30	.96	18.00	.59
Non-fat dry milk	3.10	.91	43.00	1.33
Salt	2.00	.58	1.70	.03
Monosodium glutamate	2.00	.58	75.00	1.50
Curry (powdered)	1.55	.45	95.00	1.47
Vinegar	1.10	.32	8.58	.09
Garlic	.45	.13	115.00	.52
Parsley (dehydrated)	.35	.11	245.00	.86
Total (approx.)	342.85	100.00		130.46
Ingredient cost: per 100 pounds =				38.052
per pound =				.381

<sup>1</sup>Calculated at a 50 per cent yield from 50 cents per pound raw material (Choice lamb chucks).

**Government Grant Study  
Carried Out In Meat  
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used instead of fresh, but still remained at a high level. Canned apples did not provide the texture or flavor desirable in a curry. Ingredient cost per pound was estimated at \$0.38 and total production cost, including packaging, at \$0.57.

In organoleptic testing of the lamb products, 9 hedonic degrees were recognized, ranging from 1 "Very highly unacceptable" to 9 "Very highly acceptable." (See Table 1) The lamb curry was rated as highly acceptable by a trained taste panel, and 98 percent of a home-panel rated its overall appeal as good or acceptable. Under test use as an institutional item, the curry rated high in such attributes as appearance and flavor. Ninety-seven percent of the people in the institutional test indicated they would purchase the curry again if available.

The concept of a curry seemed to be well received by consumers in all tests. An added advantage is the fact that the word "curry" appears to be strongly associated with lamb in the minds of consumers. The product itself offers much flexibility (through seasoning variations) in catering to the tastes of different segments of the market. The convenience of the pre-cooked boilable-bag type of presentation was appreciated by consumers generally, but particularly by those who worked outside the home. The manufacturing procedures lend themselves readily to on-line mass production. On the basis of information received from

**Table 2. INGREDIENTS AND PROJECTED COSTS FOR LAMB SHANKS ENTREE  
The Pennsylvania State University 1970**

Ingredients	Quantity		Unit cost (cents/lb.)	Total cost (dollars)
	Pounds	Per cent		
Lamb shanks <sup>1</sup>	100.00	64.10	38.00	38.00
Sauce <sup>2</sup>	35.00	22.43	33.16	11.53
Rice mixture <sup>3</sup>	21.00	13.47	19.99	4.20
	156.00	100.00	34.48	53.73
<sup>1</sup> Calculated at a 40 per cent yield from 15 cents per pound raw material				
<sup>2</sup> Sauce				
Tomato ketchup	27.10	77.42	28.00	7.59
Worcestershire sauce	1.85	5.29	80.00	1.48
Onion (dehydrated)	1.80	5.14	115.00	2.07
Vinegar	1.70	4.86	9.00	.15
Salt	1.25	3.57	1.70	.02
Brown sugar	1.00	2.86	18.00	.11
Dry mustard	.30	.86	38.00	.11
	35.00	100.00	33.16	11.53
<sup>3</sup> Rice mixture				
Rice	16.74	79.71	22.00	3.68
Carrots	3.70	17.62	12.00	.44
Salt	.50	2.38	1.70	.01
Garlic	.04	.19	115.00	.05
Majoram	.02	.10	81.50	.02
	21.00	100.00	19.99	4.20
Ingredient cost: per 100 pounds =				34.442
per pound =				.344

these preliminary tests, lamb curry appears to be equally suited for institutional and retail trades.

#### Lamb Shanks

Shanks comprise the lower part of the carcass extremities and the fore shank, as used in this project, contains the elbow joint and fore-shank bones. For this product the shanks are boned, precooked and packaged with a sauce in a boilable bag and served over rice.

Ingredient cost per pound was estimated at \$0.34 and total production cost, including packaging, at \$0.53.

This product was rated as "about

average acceptable" (see Table 2) by a trained taste panel. It was highly rated as an institutional item, with 95 percent of respondents rating its appearance and flavor as excellent or good.

Lamb shank entree received a high rating in the cafeteria test and indicates good potential for the HRI market. However, more information on the requirements of the HRI market in regard to handling and presentation of lamb shanks is necessary.

#### Lamb Loaf

This item for the retail food market is visualized as a one-and one-



half-pound frozen meat loaf made from lamb, various vegetables, and seasonings. It is a flexible item, as the amounts and kinds of vegetables and seasonings may be altered to cater to the specific taste of each market segment.

Ingredient cost per pound was estimated at \$0.72 and total production, including packaging, at \$0.89.

This product was rated as highly acceptable by a trained taste panel (see Table 3). After 120 days storage at  $-10^{\circ}\text{F}$ . the rating was only slightly lower. The general overall appeal of the lamb loaf was rated by 90 percent of the home panel as very good or acceptable. In the institution test, appearance and flavor were rated as excellent or good by about 70 percent of respondents.

It is difficult to assess this product's potential as a retail item without further testing. Undoubtedly it could have appeal for the housewife as an over-ready entree. The obvious convenience of the prepared loaf might appeal to working housewives—or to others as an "emergency" item to keep on hand in the freezer to serve unexpected guests. The slight problem of greasiness may be eliminated by insertion of a false bottom so that fat rendered out during cooking may drain away. This would increase costs to some extent.

Perhaps this product might achieve more success in the HRI trade, as it lends itself rather readily to volume cooking and uniform handling. In addition, problems of greasiness tend to be less troublesome under the HRI handling system and perhaps could possibly be solved at less expense there. It is felt that the general overall appeal rated high enough to justify further market testing of this product.

#### Lamb Riblets

Riblets consist of the "spare ribs"

**Table 3. INGREDIENTS AND PROJECTED COSTS OF LAMB LOAF**  
The Pennsylvania State University 1970

Ingredient	Quantity		Unit cost (cents/lb.)	Total cost (dollars)
	Pounds	Per cent		
Lamb or mutton <sup>1</sup>	100.00	65.86	100.00	100.00
Water <sup>2</sup>	19.00	12.51	—	—
Cracker crumbs	12.50	8.23	12.00	1.50
Mushrooms (fresh)	11.00	7.24	40.00	4.40
Celery	2.80	1.84	10.00	.28
Salt	2.00	1.32	1.70	.03
Non-fat dry milk	2.00	1.32	43.00	.86
Margarine	1.50	.99	25.00	.38
Onion (dehydrated)	.70	.46	64.00	.45
Green pepper (dehydrated)	.30	.20	263.00	.79
Pepper, black	.04	.03	48.00	.02
Total (approx.)	151.84	100.00		108.71
Ingredient cost: per 100 pounds =				71.600
per pound =				.716

<sup>1</sup>Calculated at a 50 per cent yield from 50 cents per pound raw material (Choice lamb chucks)

<sup>2</sup>12.5 pounds to rehydrate milk

6.5 pounds to rehydrate vegetables

**Table 4. INGREDIENTS AND PROJECTED COSTS FOR LAMB RIBLETS**  
The Pennsylvania State University 1970

Item	Quantity		Unit cost (cents/lb.)	Total cost (dollars)
	Pounds	Per cent		
Lamb or mutton <sup>1</sup>	100.00	66.67	24.00	24.00
Sauce <sup>2</sup>	50.00	33.33	30.12	15.06
Total (approx.)	150.00	100.00		39.06
Ingredient cost: per 100 pounds =				26.046
per pound =				.260
<sup>1</sup> Calculated at a 50 per cent yield from 12 cents per pound raw material.				
<sup>2</sup> Sauce				
Tomato ketchup	36.10	72.20	28.00	10.80
Water	5.70	11.40	—	—
Worcestershire sauce	1.95	3.90	80.00	1.56
Diced onion (dehydrated)	1.90	3.80	115.00	2.19
Vinegar	1.80	3.60	9.00	0.16
Salt	1.10	2.20	1.70	0.02
Brown Sugar	1.10	2.20	18.00	0.20
Dry mustard	0.35	0.70	38.00	0.13
Total	50.00	100.00		15.06

section of lamb and comprise the sixth through the thirteenth rib with the flank and diaphragm muscle included. The cooked ribs are packaged in sauce in boilable bags and frozen for storage.

Ingredient cost per pound was estimated at \$0.26 and total production cost, including packaging, at \$0.45.

Riblets (see Table 4) were not extensively tested by a panel, home, or HRI arrangement. Among the staff this product had considerable appeal as a finger-food item; it was considered excellent from a flavor standpoint.

#### Lambkins (Lamb Sausage)

Lamb sausage is made from car-

cass shoulder or chucks and/or lamb or mutton trimmings to which sausage seasonings have been added. The comminuted sausage mixture may be stuffed into natural sheep casing, dipped in a liquid tenderizer, then linked to the desired length and smoked. Extruded collagen casings may be used and are considered to offer a more uniform size, thickness, relative strength, easier metering of link weight and length, and advantages in handling.

To keep the fat content consistently below 20 percent, it was found necessary to use lamb shoulders exclusively. The use of lamb trimmings was found to lower the cost considerably at the expense of

**Table 5. INGREDIENTS AND PROJECTED COSTS OF LAMB SAUSAGE**  
The Pennsylvania State University 1970

Ingredient	Quantity		Unit cost (cents/lb.)	Total cost (dollars)
	Pounds	Per cent		
Lamb or mutton <sup>1</sup>	100.00	84.969	100.00	100.00
Crushed ice	15.00	12.745	—	—
Salt	2.00	1.699	1.70	.03
Sugar	.25	.213	11.50	.03
Pepper, black	.25	.213	48.00	.12
Sage	.13	.110	61.50	.08
Mace	.06	.051	227.50	.14
Total (approx.)	117.69	100.00		100.40
Ingredient cost: per 100 pounds =				85.309
per pound =				.853

<sup>1</sup>Calculated at a 50 per cent yield from 50 cents per pound raw material (Choice lamb chucks).

**Table 6. INGREDIENTS AND PROJECTED COSTS OF MARINATED LAMB**  
The Pennsylvania State University 1970

Ingredient	Quantity		Unit cost (cents/lb.)	Total cost (dollars)
	Pounds	Percentage		
Lamb or mutton <sup>1</sup>	100.00	74.77	100.00	100.00
Vegetable oil	19.61	14.66	25.00	4.90
Lemon juice	12.95	9.68	27.71	3.59
Salt	0.98	0.73	1.70	.02
Marjoram	0.10	0.08	81.50	.08
Black pepper	0.10	0.08	48.00	.05
Total (approx.)	133.74	100.00		108.64
Ingredient cost: per 100 pounds =				81.230
per pound =				0.812

<sup>1</sup>Calculated at a 50 percent yield from 50 per pound raw material (Choice lamb chucks).

raising the fat content to 25 percent, a level found to be equally acceptable. However, if care is not taken to discard excess pieces of fat in the trimmings, the fat level of the sausage may reach higher than acceptable levels. There is a negligible weight loss due to cooking. Initial testing has indicated that mutton may be successfully used in the sausage. The more pronounced flavor of the more mature meat may even be desirable in those segments of the market that relish it.

Ingredient cost per pound was estimated at \$0.85 and total production cost, including packaging, at \$1.02.

Lamb sausage with various percentages of beef and pork added were evaluated but none rated above the all-lamb product in acceptability (see Table 5). The lamb sausage was given a rating of average acceptability by a trained taste panel. The general overall appeal of this product was rated as very good by 68 percent and acceptable by 32 percent of a home test panel. Juiciness, tenderness, and texture were all rated as very good or acceptable. In the HRI test the appearance of the sausage was rated as excellent or good by 87 percent of respondents, while 73 percent rated flavor as excellent or good.

Lamb sausage appears to be an acceptable product to the consumer and a means of turning low-priced lamb trimmings and cuts into a potentially profitable and marketable product. Results from both institutional and home tests suggest that overall taste and flavor are no problem with this product. A favorable comment, which was fairly widespread, concerned the

“meatiness” of the sausage. This may have promotional potential.

In general, based on present knowledge, it is hard to see lamb sausage competing in a serious way with pork sausage in the general mass market. However, it may have limited potential for ethnic groups, for people desiring variety and novelty, for those concerned with special diets, e.g. in hospitals. Perhaps lamb sausage would be an item for eating establishments that pride themselves on offering a wide and interesting choice for their customers. Market test areas should be chosen with the possible appeal of lamb sausage to these ethnic and special groups in mind.

#### **Shish-Kabobs (Marinated Lamb Cubes)**

Shish-kabobs consists of cubes of lamb meat packaged with a mari-

nade in a moisture-proof plastic bag and stored in the frozen state. When thawed for use, the cubes are skewered with appropriate vegetables and broiled.

Ingredient cost per pound was estimated at \$0.81 and total production cost, including packaging, at \$1.00.

The product was rated by a trained taste panel at 7.6 (highly acceptable) after 30 days in frozen storage (see Table 6).

The advantage of this product lies in its convenience. Normally marinated dishes require 24-72 hours preparation. This product eliminates this time-consuming process for the housewife or the HRI trade. Further possible variations include marinating the lamb cubes, placing them and various vegetables on a skewer, packaging and freezing to give a product ready for immediate broiling.